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Selecting the Effectiveness Strategic Capability for Sustainable Development under Risk and Uncertainty in the Oil Industry: Rough Set Theory

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ABSTRACT

This research aims to select the most effective strategic capability for sustainable development under risk and uncertainty in the oil industry by rough set theory. The research methodology is qualitative and quantitative. The target population in the qualitative section included 14 industrial management specialists at the university level, and in the quantitative section, 32 senior managers in companies active in the oil industry. In this research, the meta-synthesis and Delphi analysis methods were used to identify the components and propositions of the research and, in a small part, the analytical approaches of Ruff collection. The results showed that among the 15 final statements of risk and uncertainty in the oil industry, the risk of change in domestic law relative to political/economic diplomacy in developing infrastructure for the oil industry X5 is the most crucial risk statement and uncertainty in the field. Political and legal risks have been identified as a measure of the strategic viability of sustainable development. Finally, it was found that despite the most probable risks selected in this study, namely the risk of changes in domestic law to political/economic diplomacy in the development of infrastructure of the oil industry “X5”, the existence of sanctions of the world powers “X1” strategic capabilities of sustainable economic development is the most crucial feature that should be considered in the country’s inflationary conditions.

1. Introduction

The development structure has evolved and shifted from a strictly static basis into dynamism to achieve sustainability with the advancement of societies and modification of different aspects, such as political, economic, cultural, and social changes. Development is a dynamic, all-embracing, multidimensional phenomenon based on the above shifts, which form the foundation of the separation of countries. It is often seen as a concern in comprehensive outlooks.

The majority of planners, government officials, policymakers, researchers, and experts pursue determining a level for sustainability as a subjective challenge. They always try to create integration and coherence in achieving balanced and sustainable development by submitting plans and propositions to the governance system to strengthen the capabilities needed to raise communities' welfare (Rezaei Pendari, 2020). In other words, in determining sustainable development strategies, the objective is to improve living conditions, human capacities, expansion of facilities, human endowment, and many of society's ideals for development. This is because unsustainable industrial development has become a significant challenge in increasing countries' various threats and challenges. Moreover, economic inequality in these countries has disrupted the equilibrium of capital distribution and led to environmental degradation (Barbero and Bicocca, 2017).

The existing challenges demonstrate that countries cannot live healthy and optimal life without sustainable development strategies. Thus, they must consider specific capabilities to achieve consistent sustainability against risks and uncertainties by prioritizing their development strategies. As a result, two goals are pursued by the strategic capability for sustainable development. Firstly, they aim to identify and control the risks and uncertainties to help raise the chances of succeeding in reaching the predetermined outlooks. Secondly, they seek to integrate various development fields like environmental protection, economic effectiveness, social welfare, and cultural authenticity to improve how communities enjoy development as a general principle and objective (Stevenson and Richardson, 2010). Sustainable development capabilities are processes based on dynamic resource management and saving functions to maximize their interests for sustainable preservation. They are also a structural, social, and economic mechanism for reducing the gap of changing needs in the future by facilitating institutional changes and technological development (Voget-Kleschin, 2013). Explaining the problem of this study, though Rocha et al. (2007) believes in an integrated system of sustainable development strategies, Kim and Marcouiller (2020) believe that sustainable development capabilities should be focused on the segregation of industries to improve the degree of effectiveness. One industry in which this research was carried out is the oil industry. This study aims to select the essential strategic capability for sustainable development under risk and uncertainty in the oil industry.

For this reason, it should be noted that most oil industry experts like Salter and Ford (2000), Hilson and Basu (2003), and Ekins and Vanner (2007) believe that a significant feature of the projects is that in the oil industry projects are risky because there is a little clear basis for identifying, categorizing, and prioritizing them due to continuous environmental and all-out changes. Researching to detect such a level of uncertainty can contribute to the dynamics of sustainable development.

In describing why this study was conducted, it should be noted that, in practice, sustainable development has been put on the agenda as a fundamental approach, in line with the Vision 1404 Document. Integrated into the 6th Five-Year Development Plan, it has been attempted to proceed with sustainable development capabilities based on the segregation of industries, such as steel, oil and gas, and petrochemicals (Ghasemi et al., 2020). However, critics in different areas, such as the economy, politics, and environment, argue that economic sanctions, failure in attracting foreign investors, and inability to transfer technological and technical knowledge have questioned levels of risk and uncertainty in all areas, particularly in the oil industry, based on the completion of the existing projects or initiating new projects to pursue the above plans (Asghari, 2017).

In fact, identifying the risks in this area can help develop the functions of strategic capabilities of sustainable development and effectively create the coherence of effective mechanisms in an economic system and enable the country to increase net national production. Therefore, this study aims to identify environmental risks and uncertainties in this industry through a literature review and then select the most critical sustainable development strategic capabilities under the above risks by defining sustainable development strategic components. Therefore, the main question in this research is what is the most effective strategic capability for sustainable development under risks and uncertainties in the oil industry?

2. Literature review

2.1. Strategic capabilities for sustainable development

The capability has considerable implications for the individual, organizational, and economic spectrum on a strategic basis. It has been defined as a mechanism for increasing dynamism and flexibility to improve existing conditions toward the ideal conditions. According to Barney (1991), the principal theoretician in this field, capabilities are described as the source of valuable and scarce resources management based on a resource-based approach because all resources are heterogeneous in a particular situation, such as an economy and organization. He thinks this heterogeneity can lead to resource depletion over time because its management was unsuccessful. Capabilities are a strategic approach to achieving a sustainable competitive advantage, interpreting the difference between organizations and countries for sustainability in competitiveness and development.

Grant (2010) argues that a capability-based development strategy means that a company's resources and capabilities must be adapted to its externally occurring opportunities. Lessmann and Rauschmayer (2013) conclude that shifting from sustainable development strategies to building up strategic capabilities can contribute to resource competence and increase value by focusing on the role of resources and development capacities as a basis for strategies. For two reasons, these scientists expanded their argument. Regarding the first argument, they expressed that given the higher unsustainability of the industrial climate, the intra-organizational resources and capabilities can be further considered a secondary mechanism for further improving sustainability rather than focusing on the external market. Their second argument stated that development strategies simply aim to achieve advantages in various aspects.

Nevertheless, sustainable development capabilities help enhance the mechanisms of resource control and potential risks. It also makes resources within the value chain framework turn into potential capacities, meritocracy, and ultimately, competitive advantage. Sustainable strategic development capabilities enable businesses to act differently or modify for greater sustainability than their current state. Accordingly, suppose companies have several resources and competencies. However, this set is not supported by sustainable creation, composition, and rearrangement capabilities. In that case, the business will have acceptable performance in the short term but not achieve a long-term competitive advantage (Augier and Teece, 2009). The long-term development capabilities also underline the long-term visions on the results of present-day activities and global cooperation among countries to reach practical solutions. Scott and Rajabifard (2017) also defined sustainable development capabilities as a process of change in the use of resources, capital management, technological development orientations, and institutional changes.

Consequently, increasing sustainability requires a narrower gap between the present and future needs. Sustainable development strategies are also defined as processes that improve the situation and address social, economic, and cultural weaknesses in developing societies. These countries need a balanced and proportionate driving force in line with developed countries' economic, social, and cultural dimensions (Sandberg and Abrahamsson, 2011).

2.2. Risk and uncertainty

Risks as an adequate basis for advancing strategies have always been a challenging and near-unresolvable issue to achieve tremendous success. Risk management is a logical and systematic approach to risk analysis, assessment, and management for strategic activities that enable organizations to seize opportunities and minimize losses. The significant advantage of risk management for a company is that it usually reduces avoidable accidents and associated costs, thus contributing to business continuity. Risk management leads to informed decision-making, consistent planning, and better resource utilization. Significant factors that caused organizations and businesses to face many unforeseen risks over their lives include complex environments, high competition, state-of-the-art technologies, developed ICTs, new ways of delivering goods and services, and environmental concerns. The risk comes from the interplay of project goals, i.e., time, cost, quality, performance, scope, and uncertainty. This may be seen as a threatening factor (the damaging risk that endangers the project objectives) or the one offering opportunities (beneficial risks that facilitate and accelerate the achievement of project objectives). Therefore, strategies determine the uncertainties that can be seen as risks.

In contrast to the above approach, which sees risks as positive and negative possible fluctuations in revenues, a conflicting view limits the risk to possible adverse fluctuations only. If the risk is only used negatively, it corresponds to danger (hazard). When the various risk management criteria are first reviewed, it may appear that the definitions offered for risk and its consequences are not yet coherent. Superficial risk and uncertainty are the unknown factors that require a thorough understanding of future possibilities. A critical point in this respect is identifying the types of risks associated with strategies that can confront them along the way. This means that risk identification aims to manifest and record the details of the most uncertain events before they occur. This allows the management space necessary to address the risks before they potentially happen. There is no way all potential risks to a project can be identified. Stevenson and Richardson (2010) stated the reasons why risks are not identified in the following framework.

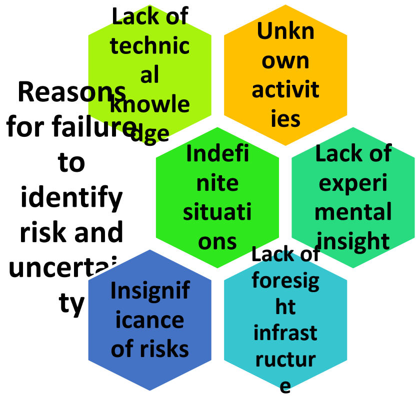

Figure 1. Reasons for failure to identify risks toward developed strategies.

Risk classification can provide a structure that disciplines risk identification and improves the efficiency and quality of risk identification. Various associations and experts in risk management have offered different perspectives on classifying risk, which classify risks based on origins, control and management officer, and internal or external. According to the theoretical foundations, the research questions are as follows:

1. What are the risk and uncertainty propositions in the oil industry?
2. What are the components of the strategic capabilities for sustainable development in the oil industry?
3. What are the most significant risk and uncertainty propositions in the oil industry?
4. What is the most effective strategic capability for sustainable development under risk and uncertainty in the oil industry?

3. Methodology

This is a developmental study in terms of purpose. The theoretical and analytical strategic development capabilities and analytical conditions lack a consistent framework. Since this study seeks to develop the theoretical foundation of this concept under risk and uncertainty, it is considered developmental research. Moreover, it is descriptive research in terms of the purpose of explaining the phenomenon concerned in the oil industry. Finally, it is inductive-deductive research concerning the rationale for data collection. In the qualitative part, the theoretical foundations of sustainable strategic development capabilities components are primarily analyzed using the inductive approach. Then, the component and propositions identified in the target population are explained based on the deductive approach.

In the qualitative part of this research, mixed-research meta-analysis has been used. The meta-analysis includes steps taken toward reaching components and propositions. The process steps of Sandelowski and Barroso are perhaps the most significant of these steps (2008). It ranges from acknowledging the root cause for a problem in the form of a research question through the panel members' participation in formulating a particular model based on identifying components and propositions from past research. The most effective strategic capabilities for sustainable development are then identified in the quantitative part by analyzing rough theories. In other words, the most effective strategic capability for sustainable development is selected in the oil industry by analyzing rough sets based on risk and uncertainty propositions.

3.1. Statistical population and sampling method

This study's statistical population consists of the qualitative and quantitative sections. In the qualitative part, the target audience involves functional studies on research topics and 14 industrial management experts interested in studying and identifying risk and uncertainty statements and strategic capability components of sustainable development based on the meta-synthesis framework, critical assessment, and Delphi analysis. A homogeneous qualitative sampling approach was used in panel community participants to select these individuals. The researcher chooses his/her samples in this sampling system to acquire intensely, distilled, and thorough expertise from those who have encountered this phenomenon and can provide the researcher with much information (Sadeghi Fasaei and Naseri Rad, 2012). However, the companies active in the oil industry target population was a limited number of 32 managers levels, appropriate to the statistical population, because the purpose of the participation of this community is to explain the results of the quality sector at the level of these industries companies. Since this approach focuses on analyzing complex structures in some stages, which should focus on particular criteria such as participants' knowledge or competence, it allows up to 32 persons to engage in the cross-matrix questionnaire due to the lack of specific criteria nonsensical responses. The optimum sample size allocation in the range of 15 to 25 individuals was projected by researchers such as Zhang et al. (2016), Shieng et al. (2007), and Pavlak (2005) and based the allocation of the sample population on the available sampling tool according to the filters in line with the design of the analysis.

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4. Research validity

The content validity ratio (CVR) was used to validate the validity of the constructed questionnaires, based on which 10 panel members were asked to fulfill three "important" criteria; to determine "useful but not appropriate" and "unnecessary" claims. Each researcher selected one of the above three choices to affirm the study's validity. In the end, all the propositions were determined to be above the set standard CVR and were approved.

5. Procedures of the rough set theory

Pawlak (1982) introduced the Rough sets as a valuable mathematical instrument in uncertainty conditions (Pawlak, 1982). After the Rough set theory, Zhai et al. (2002) proposed the Rough numbers. A Rough number usually includes "lower limit", "upper limit", and "rough boundary interval", which depend only on the original data. Therefore, there is no need for supplementary data, and this can gain a better understanding of the experts' intended concepts and improve the decision-making objectivity (Pawlak, 1982).

Suppose that "U" is a reference set including all members, "Y" is an arbitrary member of U and R sets belonging to "t class". R={G1, G2,…, Gt}, which covers all members of U. If these classes are in order as G1< G2<...<Gt, then $\forall\ Y \in U.\ G_q \in R.\ 1 \le q \le t$.

The lower approximation ($\underline{Apr}\left(G_q\right)$), the upper approximation ($\overline{Apr}\left(G_q\right)$ and the boundary area (Bnd $\left(G_q\right)$)3 belonging to class Gq are defined as:

$$\underline{Apr}\left(G_q\right) = \cup\left\{Y \in U \middle| R(Y) \le G_q\right\} \quad (1)$$

$$\overline{Apr}\left(G_q\right) = \cup\left\{Y \in U \middle| R(Y) \ge G_q\right\} \quad (2)$$

$$\begin{aligned} \text{Bnd}\left(G_q\right) &= \cup\left\{Y \in U \middle| R(Y) \ne G_q\right\} \\ &= \left\{Y \in U \middle| R(Y) > G_q\right\} \\ &\cup \left\{Y \in U \middle| R(Y) < G_q\right\} \end{aligned} \quad (3)$$

Then, Gq can be presented using a Rough number RN (Gq)4 in its corresponding lower and upper limits: (Equations (4)–(6)).

$$\underline{\mathrm{Lim}}(G_q) = \frac{1}{M_L}\sum R(y)|Y \in \underline{\mathrm{Apr}}\,(G_q) \quad (4)$$

$$\overline{\mathrm{Lim}}(G_q) = \frac{1}{M_U}\sum R(y)|Y \in \overline{\mathrm{Apr}}(G_q) \quad (5)$$

$$RN(G_q) = [\underline{\mathrm{Lim}}(G_q).\overline{\mathrm{Lim}}(G_q)] \quad (6)$$

where MU and ML are respectively the values of members $\underline{\mathrm{Apr}}\,(G_q)$ and $\overline{\mathrm{Apr}}(G_q)$.

It is clear that the lower and upper limits determine the mean value of the elements related to upper and lower approximations respectively, and their difference is defined as "Rough boundary interval".

$$IRBnd(G_q) = \overline{\mathrm{Lim}}(G_q) - \underline{\mathrm{Lim}}(G_q) \quad (7)$$

The Rough boundary interval expresses the ambiguity of "Gq", so that its larger value means more ambiguity, while the smaller value has higher accuracy. Thus, the subjective data can be expressed by the Rough numbers (Ima et al., 2008: 34).

5.1. Gray hierarchy analysis process

The gray hierarchy analysis process is one of the most famous and commonly used multiple decision making, which can measure the level of preferences' consistency and consider the tangible and intangible criteria. The gray relational analysis method is used to select the best choice based on the number of criteria. Like the TOPSIS and Vikor techniques, this method starts with a decision matrix; however, in addition to distinguishing between the positive and negative criteria, it also distinguishes between the most desirable value. The gray hierarchy analysis process was used in this research because the experts' judgments were subjective and ambiguous. In the following, the gray hierarchy analysis process is presented in step 1. Determine the goals, criteria, and choices of the research and form the hierarchy structure.

Step 2. Prepare the pairwise comparison questionnaire and collect the experts' opinions.

Step 3. Using the concept of Rough theory to change the experts' preferences to interval numbers and form the interval pairwise comparison matrix like the below equation:

$$M = \begin{bmatrix} [1.1] & [x^L_{12}.x^U_{12}] & \dots & [x^L_{1m}x^U_{1m}] \\ [x^L_{21}x^U_{21}] & [1.1] & \dots & [x^L_{2m}x^U_{2m}] \\ & & \cdot & \\ & & \cdot & \\ & & \cdot & \\ [x^L_{m1}x^U_{2m}] & [\dots & \dots & [1.1] \end{bmatrix} \quad (8)$$

where x^L_{ij} is the lower limit, and x^U_{ij} indicates the upper limit (p. 11).

Before computing interval numbers, the inconsistency rate of the pairwise comparison questionnaires should be measured, and if this rate is acceptable (below 0.1), we can compute the interval numbers.

Step 4. Calculating the weight of each of the research's criteria using Equations (9) and (10)

$$w_i = \left[\sqrt[m]{\prod_{j=1}^{m} x^L_{ij}}\,.\,\sqrt[m]{\prod_{j=1}^{m} x^U_{ij}}\right] \quad (9)$$

$$w_i' = w_i/\max(w_i^u) \quad (10)$$

where W1' is a normalized form. Finally, the weight of the research criteria is obtained (Zhu et al., 2015: 413).

5.2. Gray Vikor method

Step 1: In the Vikor method, the decision matrix is formed. Since we have used the Gray Vikor method in this research, the Vikor questionnaire completed by the experts must be first changed into the interval numbers using the Rough theory concept, then perform calculations using the Gray Vikor method. In the following, the Gray Vikor method is presented:

Step 1: Forming the interval decision matrix obtained from the Rough theory,

$$D = \begin{bmatrix} [f^L_{11}f^U_{11}] & [f^L_{12}f^U_{12}] & \dots & [f^L_{1m}f^U_{1m}] \\ [f^L_{21}f^U_{21}] & [f^L_{22}f^L_{22}] & \dots & [f^L_{2m}f^U_{2m}] \\ [f^L_{n1}f^U_{n2}] & [f^L_{n2}f^U_{n2}] & \dots & [f^L_{nm}f^U_{nm}] \end{bmatrix} \quad (11)$$

Step 2: Determining the best (the most desirable) value f_j^* and the worst value f_{ij}^- in each criterion of matrix D. For positive criterion (with the profit nature), the largest number shows the best value, and the smallest value shows the worst value:

$$f_j^* = \mathrm{Max}_i f^U_{ij}\,.\,f_{ij}^- = \mathrm{Min}_i f^L_{ij} \quad (12)$$

It is vice versa for negative criterion (with the expense nature):

$$f_j^* = Min_i f_{ij}^U . f_{ij}^- = Max_i f_{ij}^L \quad (13)$$

In general, the best and the worst values are obtained as follows:

$$f_j^* = \{(Max_i f_{ij}^U | j \in B) or (Min_i f_{ij}^L | j \in C)\} \quad (14)$$

$$f_j^- = \{(Min_i f_{ij}^L | j \in B) or (Max_i f_{ij}^U | j \in C)\} \quad (15)$$

where *B* is a set of positive criteria, and *C* is a set of negative criteria.

Step 3: Calculating the values of $[S_i^L S_i^U]$ and $[R_i^L R_i^U]$

$$S_i^L = \sum_{j \in B} W_j^L \left(\frac{f_j^* - f_{ij}^U}{f_j^* - f_j^-}\right) + \sum_{j \in B} W_j^L \left(\frac{f_{ij}^L - f_j^*}{f_j^- - f_j^*}\right) \quad (16)$$

$$S_i^U = \sum_{j \in B} W_j^U \left(\frac{f_j^* - f_{ij}^L}{f_j^* - f_j^-}\right) + \sum_{j \in B} W_j^U \left(\frac{f_{ij}^U - f_j^*}{f_j^- - f_j^*}\right) \quad (17)$$

$$R_i^L = max_j \begin{cases} W_j^L \left|\frac{f_j^* - f_{ij}^U}{f_j^* - f_j^-}\right| j \in B \\ W_j^L \left|\frac{f_{ij}^L - f_j^*}{f_j^- - f_j^*}\right| j \in C \end{cases} \quad (18)$$

$$R_i^U = max_j \begin{cases} W_j^U \left|\frac{f_j^* - f_{ij}^L}{f_j^* - f_j^-}\right| j \in B \\ W_j^U \left|\frac{f_{ij}^U - f_j^*}{f_j^- - f_j^*}\right| j \in C \end{cases} \quad (19)$$

where W_j^L is the lower limit, and W_j^U represents the upper limit of each criterion's weight.

Step 4: Calculating the values of $[Q_i^L Q_i^U]$

$$Q_i^L = v\left(\frac{S_i^L - S^*}{S^- - S^*}\right) + (1 - v)\left(\frac{R_i^L - R^*}{R^- - R^*}\right) \quad (20)$$

$$Q_i^U = v\left(\frac{S_i^U - S^*}{S^- - S^*}\right) + (1 - v)\left(\frac{R_i^U - R^*}{R^- - R^*}\right) \quad (21)$$

$S^* = Min_i S_i^L$ ، $S^- = Max S_i^U$ ، $R^* = Min_i R_i^L$ $R^* = Max_i R_i^U$

Q is a cumulative index, and *v* indicates the weight of the maximum criterion policy given by $v \in [0.1]$: usually $v = \frac{0}{5}$

Step 5: Ranking choices according to S, R, and Q.

Since the Gray Vikor method suggests the interval weights for the research choices, the weight of the choices, similar to the Vikor method, cannot be easily ranked according to the Q index. In order to rank the interval weights, several ways are described below.

$$A = [a_1 . a_2]; B[b_1 . b_2] \quad (22)$$

$$C = [c_1 . c_2] = A - B = [a_1 - b_2 . a_2 - b_1] \quad (23)$$

$$IF \frac{|c_1|}{c_2 - c_1} < \frac{|c_2|}{c_2 - c_1} \rightarrow Then\ A > B \quad (24)$$

$$IF \frac{|c_1|}{c_2 - c_1} < \frac{|c_2|}{c_2 - c_1} \rightarrow Then\ A \leq B \quad (25)$$

6. Findings

6.1. Meta-synthesis and Delphi findings

It was first used via databases and research references to perform meta-synthesis. Thus, this study examines the components relevant to the U-BEE and the propositions for technological startup growth, depending on the meta-analysis and Delphi analysis method. On this basis, the following databases and academic references are used to derive similar research related to the research subject.

Table 1.: Information data banks and official research references.

Internal databases	External databases
MAGIRAN	Sciencedirect
NOORSOFR	Emeraldinsight
SID	OnlineLierary

According to the protocol and hyper-combination assessment process, a range of relevant and accurate study studies was found from 2015 to 2020. The study relevant to the research purpose was defined to identify comparable papers and inquiries and use the above research bases and sources.

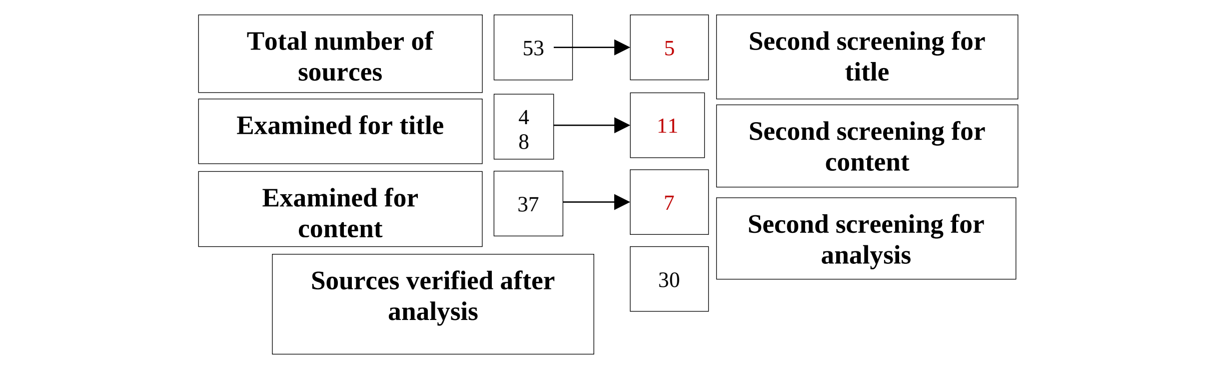

Figure 2. Screening analysis of research proportionate.

Based on three aspects of the title, content, and review of the study screening, it was decided that 30 research studies should be used as a basis for assessment to define the components of the university entrepreneurship ecosystem and the propositions for technological startup growth. Following this stage, the themes were classified and divided into components and propositions in the following process, based on the Sterling (2001) methodology. According to this approach, with the aid of 14 research experts, the first 30 studies accepted by 10 critical assessment method criteria, including research goals, research method reasoning, research architecture, sampling, data processing, reflectivity, analytical precision, theoretical and transparent expression of findings and research importance, are prepared to achieve a more coherent understanding. Action is taken separately to create a more coherent understanding of identifying components and propositions.

a. Identifying the Propositions of Risk and Uncertainty (*x*)

Propositions of risk and uncertainty are decided in this section, as defined, based on the Sterling (2001) process, based on the meta-synthesis and critical assessment scale.

Table 2. The process of evaluating the approved research.

	External research										Internal research					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Kassem et al. (2020)	Jagoda and Wojcik (2019)	Kassem et al. (2019)	Ochieng et al. (2018)	Shqairat and Sundarakani (2018)	Sumbal et al. (2018)	Tan and Ma (2017)	Dutta (2017)	Wan Ahmad et al. (2016)	Lee et al. (2016)	Malekshah and Seyed Morteza Hosseini (2020)	Takurosta et al. (2019)	Mahmoud and Shirmard ;Dezki (2019)	Heydari Fatehabad and Taklif (2018)	Askari et al. (2017)	Emami Meybodi and Hadi (2017)
Research objective	4	3	4	2	2	3	5	2	3	3	3	4	2	4	3	3
Research method	4	3	3	2	3	4	5	3	3	4	3	4	2	4	4	3

Research design	4	3	4	2	3	3	4	2	2	4	4	4	2	5	4	4
Sampling method	4	4	4	3	4	4	4	2	3	4	3	4	3	4	4	3
Collection method	3	5	3	3	3	4	4	3	2	4	3	5	2	5	3	4
Generalizing findings	4	4	4	3	2	4	4	3	3	4	4	4	3	4	4	3
Ethics	5	3	4	2	3	3	5	2	3	4	3	4	2	3	4	4
Statistical analysis	4	4	3	2	2	4	5	3	3	4	4	۵	3	4	4	4
Theoretical capacity	4	3	3	2	3	4	4	2	3	5	4	4	3	3	4	3
Research value	4	3	4	3	3	4	4	2	3	4	4	5	3	4	4	3
Total	**36**	**35**	**36**	**25**	**29**	**37**	**44**	**24**	**28**	**40**	**35**	**43**	**25**	**39**	**38**	**35**
Confirmed/excluded	Confirmed	Confirmed	Confirmed	Excluded	Excluded	Confirmed	Confirmed	Excluded	Excluded	Confirmed	Confirmed	Confirmed	Excluded	Confirmed	Confirmed	Confirmed

The scores presented based on the mode index revealed that five studies that were approved scored less than 30 of 50, including Ochieng, Shqairat, Sandarakani (2018), Dota (2017), Wan Ahmad et al. (2016), and Mahmoud and Shirmardi-Dezki (2019). Studies ranked 30 and above were excluded according to the guidelines on the adequacy of the scoring of this study. The research subjects (themes) are then extracted using the Trade-Sterling approach (2001). The following scoring technique is used to assess the risk and uncertainty propositions. Accordingly, all sub-criteria extracted from the texts of approved articles are written in the table column. The names of the researchers for the approved research will then be given in the row of each table. The symbol "☑"is then inserted based on the sub-criteria used by each researcher in the table column. The scores of each ☑ will then be summed up and inserted into the column for sub-criteria. Scores higher than the average of the research conducted would then be chosen as research components.

Table 3. The process of determining the main research components.

Researchers	Economic risks	Technical and technological risks	Political risks	Legal risks	Structural risks	Financial risks
Kassem et al. (2020)	-	☑	☑	-	☑	-
Jagoda and Wojcik (2019)	-	-	-	☑	-	-
Kassem et al. (2019)	-	-	☑	-	☑	-
Sumbal et al. (2018)	-	☑	-	☑	-	☑
Tan and Ma (2017)	☑	☑	☑	-	☑	-
Lee et al. (2016)	-	-	-	-	☑	☑
Malekshah and Seyed Morteza Hosseini (2020)	-	☑	-	-	-	-

Researchers	Economic risks	Technical and technological risks	Political risks	Legal risks	Structural risks	Financial risks
Takurosta et al. (2019)	☑	-	☑	☑	☑	☑
Heydari Fatehabad and Taklif (2018)	☑	-	-	☑	☑	-
Askari et al. (2017)	☑	☑	-	☑	-	☑
Emami Meybodi and Hadi (2017)	-	☑	☑	-	☑	-
Total	4	6	5	5	7	4
Confirmed/excluded/combined	Excluded	Confirmed	Combined		Confirmed	Excluded

Based on this analysis, the most frequent risks were the three critical propositions of technological, political/legal, and structural risks. Accordingly, they are analyzed as the critical criteria for evaluating risk and uncertainty propositions. In this section, the propositions are then determined according to Table 4 after examining the theoretical foundations of the approved research.

Table 4. Risk and uncertainty propositions.

Main propositions	**Description**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Political and legal risks	Risk of confiscation of oil and gas exports due to sanctions by world powers							
	Risk of bribery and collusion in the development of oil industry investment projects							
	Risk of changes in governments' approaches to diplomacy to transfer technical knowledge to the country							
	Risk of political instability among politically active factions in the development of oil and gas projects							
	Risk of industrial terrorism due to cyber intrusion into and disruption of oil and gas systems							
	Risk of union gatherings and protests against the salary conditions of employees in this area							
	Risk of changes in domestic law relative to political/economic diplomacy in the development of oil industry infrastructure							
Technical and technological risks	Risk of changes in upstream technology under technological dependencies							
	Risk of changes in consumption-reducing behaviors							
	Risk of being able to manage large complex projects due to lack of technical knowledge and expertise							
	Sufficiency risk of exploration wells and evaluation of the development of future investment projects							
	Technical and knowledge risks in geology for the development of oil and gas fields, such as the type of structure.							
	Risk of failure to accurately estimate requirements							
	Risk of expertise and efficiency of employers in charge of oil and gas development projects							

Main propositions	Description	7	6	5	4	3	2	1
Structural and management risks	Accident management risk in investment projects in the oil industry							
	Risk of oil and gas leakage at sea and an increase in environmental pollution							
	Risk of rising costs due to structural complexities in the development of the oil industry							
	Risk of supply and development of oil industry projects							
	Legal risk of complaints about the location of oil and gas projects							
	Operational risks, such as breakdowns and shutdowns of machinery in the development of oil and gas projects							
	Risk of insufficient expertise in the development of oil and gas projects							

The Delphi analysis was then utilized to identify the components and indicators for the theoretical saturation point. To this end, experts received these indicators in the form of a seven-point survey checklist. The Delphi analysis results are presented in Table 5.

Table 5. First-round Delphi analysis process.

Proposition	Description	First-round Delphi		Second-round Delphi		Result
		Mean	Concordance coefficient	Mean	Concordance coefficient	
Political and legal risks	Risk of confiscation of oil and gas exports due to sanctions by world powers	5.50	0.75	6	0.80	Confirmed
	Risk of bribery and collusion in the development of oil industry investment projects	5.10	0.55	5.20	0.60	Confirmed
	Risk of changes in governments' approaches to diplomacy to transfer technical knowledge to the country	3.50	0.30	***Excluded***		
	Risk of political instability among politically active factions in the development of oil and gas projects	5.10	0.55	5.10	0.58	Confirmed
	Risk of industrial terrorism due to cyber intrusion into and disruption of oil and gas systems	5.50	0.78	6.10	0.82	Confirmed
	Risk of union gatherings and protests against the salary conditions of employees in this area	4	0.35	***Excluded***		
	Risk of changes in domestic law relative to political/economic diplomacy in the development of oil industry infrastructure	5.30	0.64	5.50	0.80	Confirmed

Proposition	Description	First-round Delphi		Second-round Delphi		Result
		Mean	Concordance coefficient	Mean	Concordance coefficient	
Technical and technological risks	Risk of changes in upstream technology under technological dependencies	6	0.80	6.20	0.85	Confirmed
	Risk of changes in consumption-reducing behaviors	4	0.35	***Excluded***		
	Risk of being able to manage large complex projects due to lack of technical knowledge and expertise	3.50	0.30	***Excluded***		
	Sufficiency risk of exploration wells and evaluation of the development of future investment projects	5.20	0.60	5.30	0.65	Confirmed
	Technical and knowledge risks in geology for developing oil and gas fields, such as the type of structure.	6	0.80	6.20	0.85	Confirmed
	Risk of failure to accurately estimate requirements	5.20	0.60	5.50	0.75	Confirmed
	Risk of expertise and efficiency of employers in charge of oil and gas development projects	6	0.80	6.20	0.85	Confirmed
Structural and management risks	Accident management risk in investment projects in the oil industry	5.50	0.75	6.10	0.82	Confirmed
	Risk of oil and gas leakage at sea and an increase in environmental pollution	5.20	0.60	5.20	0.62	Confirmed
	Risk of rising costs due to structural complexities in the development of the oil industry	3	0.20	***Excluded***		
	Risk of supply and development of oil industry projects	5	0.50	5.10	0.55	Confirmed
	Legal risk of complaints about the location of oil and gas projects	3	0.20	***Excluded***		
	Operational risks, such as breakdowns and shutdowns of machinery in the development of oil and gas projects	5.50	0.75	6.10	0.82	Confirmed
	Risk of insufficient expertise in the development of oil and gas projects	5.20	0.60	5.50	0.75	Confirmed

Delphi analysis showed that six propositions were excluded in the two rounds of Delphi analysis because they scored below five given the seven-point Likert scale and its concordance coefficient (below optimum 0.5).

They were therefore excluded, and the other propositions were approved.

b. Determining the components of strategic capabilities for sustainable development (Y)

As in the past section, the components related to sustainability strategic capabilities as the basis (law in the process of rough analysis) are extracted by determining the components related to this section at the market level based on the critical assessment scale.

Table 6. The process of evaluating approved research.

	External research										Internal research			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Chauhan et al. (2020)	**Famiyeh et al. (2020)**	**Jiang et al. (2019)**	**Subramaniam et al. (2019)**	**Singla et al. (2018)**	**Essid and Berland (2018)**	**Souza et al. (2017)**	**Escobar and Verdenburg (2016)**	**Read and Arayici (2015)**	**Sook-Ling et al. (2015)**	**Safari et al. (2019)**	**Eqbal Majd et al. (2018)**	**Jalili Bal et al. (2018)**	**Shah Tahmasebi et al. (2016)**
Research objective	4	3	4	2	3	2	4	5	4	2	3	2	4	2
Research method rationale	3	3	4	2	3	3	4	4	5	2	3	3	4	3
Research design	4	3	3	2	3	2	5	3	4	2	4	2	3	2
Sampling method	4	2	4	3	4	3	4	4	4	3	3	3	4	2
Collection method	3	3	4	2	3	3	5	4	4	2	4	3	4	3
Generalizing findings	4	2	4	3	4	3	4	3	4	3	3	3	4	1
Ethics	3	2	3	3	4	2	3	4	4	2	4	2	4	2
Statistical analysis method	3	2	4	3	3	3	4	4	3	3	4	3	4	3
Theoretical capacity	4	3	4	2	4	3	5	5	4	3	3	3	4	3
Research value	4	3	4	3	4	3	4	4	5	3	3	3	4	2
Total	**36**	**29**	38	**25**	**34**	**27**	42	**40**	**43**	**25**	**35**	**27**	**39**	**23**
Confirmed/excluded	Confirmed	Excluded	Confirmed	Excluded	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed	Excluded	Confirmed	Excluded	Confirmed	Excluded

Based on these analyses, five studies have been reported to fail in obtaining the acceptable score, namely Radhauen et al. (2020), Aghij et al. (2019), Lee and Harold (2016), Hawn and Lavano (2016), and Khajavi and E'temadi Jooryabi (2015). They failed to obtain an acceptable score and thus, were excluded. The research subjects are then extracted using the Sterling method (2001). Consequently, the following scoring method is employed to determine the strategic propositions for carbon disclosure. Under this method, the table column lists all sub-criteria extracted from the text of the approved articles. Then, each table row lists the names of the researchers of the approved research. Symbol ☑ symbol is inserted for any researcher who has used the sub-criteria in the table column. Each ☑ score is then summed up in the sub-criteria column. Scores higher than the average of the research conducted will be selected as the research components.

Table 7. Analysis of the main components of the strategic capabilities.

Research location	Researchers	Sustainable economic development	Sustainable social development	Sustainable cultural development	Sustainable political development	Sustainable environmental development	Sustainable technological development
External	Chauhan et al. (2020)	-	-	☑	-	-	-
	Jiang et al. (2019)	☑	-	-	☑	☑	☑
	Singla et al. (2018)	☑	☑	-	-	-	-
	Essid and Berland (2018)	-	☑	-	☑	-	-
	Souza et al. (2017)	☑	☑	☑	-	☑	☑
	Escobar and Verdenburg (2016	-	-	-	-	☑	-
	Read and Arayici (2015)	☑	☑	-	-	☑	-
Internal	Safari et al. (2019)	-	☑	-	-	-	-
	Jalili Bal et al. (2018)	☑	-	-	-	☑	-
Total		**5**	**5**	**2**	**2**	**5**	**2**
Confirmed/excluded		Confirmed	Confirmed	Excluded		Confirmed	Excluded

This analysis demonstrated that the three strategic capabilities of sustainable development, namely economic, social, and environmental, were determined based on meta-synthesis analysis. This section determined the proposed propositions according to Table 8, following the analysis of the theoretical foundations of the approved research.

Table 8. Components of strategic capabilities for sustainable development.

Main components	Propositions	7	6	5	4	3	2	1
Strategic capability of sustainable economic development	The agility of financing the implementation of investment projects							
	Increasing the ability to export to world markets under sanctions							
	Development of investment capacity in refining development projects							
	Ability to attract foreign investors to finance the project and transfer technical knowledge							

Main components	Propositions	7	6	5	4	3	2	1
	Increasing the ability to assess investment opportunities in the region's oil industry for sustainable economic development							
	Developing the level of technologies with the aim of sustainable production with minimum cost and exploration of oil and gas fields							
	Increasing the level of working capital in the oil industry							
Strategic capability of sustainable social development	Increasing the capacity and use of indigenous capabilities in the development of the oil industry							
	Increasing focus on social responsibilities and timely fulfillment of citizens' needs							
	Increasing the level of citizen participation in the development of national social oil and gas projects							
	Creating a culture of energy consumption to increase sustainability in the oil industry							
	People's social investment in developing crisis management projects							
	Evaluating and measuring social needs in providing services in the oil industry							
	Using social capacities to invest in oil and gas projects through the sale of bonds							
Strategic capability of sustainable environmental development	Evaluating the geography of project deployment to minimize environmental pollution							
	Focusing on climatic and geographical coexistence orientations in the development of the oil industry							
	Sustainable production strategies to reduce environmental pollution							
	Focusing on the development of alternative energy sources instead of fuel energy							
	Investing in waste recycling technologies to reduce environmental pollution							
	Developing industrial infrastructure for sustainable environmental protection							
	Developing standards and regulatory areas in waste management of oil and gas companies							

The Delphi analysis was then used to achieve the theoretical saturation point to ensure the identified components and propositions. To this end, experts have been given these propositions as a seven-point checklist. The Delphi analysis results are presented in Table 9.

Table 9. First-round Delphi analysis process.

Proposition	Description	First-round Delphi		Second-round Delphi		Result
		Mean	Concordance coefficient	Mean	Concordance coefficient	
Sustainable economic development	The agility of financing the implementation of investment projects	5	0.65	5.30	0.65	Confirmed
	Increasing the ability to export to world markets under sanctions	5.20	0.65	5.50	0.75	Confirmed
	Development of investment capacity in refining development projects	3.50	0.30	***Excluded***		

Proposition	Description	First-round Delphi		Second-round Delphi		Result
		Mean	Concordance coefficient	Mean	Concordance coefficient	
	Ability to attract foreign investors to finance the project and transfer technical knowledge	5.30	0.65	5.50	0.75	Confirmed
	Increasing the ability to assess investment opportunities in the region's oil industry for sustainable economic development	5.50	0.78	6.10	0.82	Confirmed
	Developing the level of technologies with the aim of sustainable production with minimum cost and exploration of oil and gas fields	5.20	0.60	5.30	0.65	Confirmed
	Increasing the level of working capital in the oil industry	5.20	0.64	5.30	0.70	Confirmed
Sustainable social development	Increasing the capacity and use of indigenous capabilities in the development of the oil industry	5.50	0.75	0.77	6.10	0.82
	Increasing focus on social responsibilities and timely fulfillment of citizens' needs	4	0.35	***Excluded***		
	Increasing the level of citizen participation in the development of national social oil and gas projects	2	0.20	***Excluded***		
	Creating a culture of energy consumption to increase sustainability in the oil industry	5.20	0.60	5.30	0.65	Confirmed
	People's social investment to develop crisis management projects	5	0.65	5.20	0.75	Confirmed
	Evaluating and measuring social needs in providing services in the oil industry	3	0.20	***Excluded***		
	Using social capacities to invest in oil and gas projects through the sale of bonds	6	0.80	6.20	0.85	Confirmed
Sustainable environmental development	Evaluating the geography of project deployment to minimize environmental pollution	5	0.50	5.10	0.55	Confirmed
	Focusing on climatic and geographical coexistence orientations in the development of the oil industry	4	0.35	***Excluded***		

Proposition	Description	First-round Delphi		Second-round Delphi		Result
		Mean	Concordance coefficient	Mean	Concordance coefficient	
	Sustainable production strategies to reduce environmental pollution	3	0.20	***Excluded***		
	Focusing on the development of alternative energy sources instead of fuel energy	5	0.50	5.10	0.55	Confirmed
	Investing in waste recycling technologies to reduce environmental pollution	5.20	0.60	5.30	0.65	Confirmed
	Developing industrial infrastructure for sustainable environmental protection	5.50	0.75	6.10	0.82	Confirmed
	Developing standards and regulatory areas in waste management of oil and gas companies	5.20	0.60	5.50	0.75	Confirmed

The Delphi analysis showed that five sub-components were excluded because their average was less than five, given that the seven-point Likert scale and their concordance coefficient were less than 0.5. They were excluded on this basis, but the remainder of the sub-components reached theoretical adequacy.

Table 10. Coding components for rough analysis.

Purpose	Elements	Research component codes
Components of strategic capabilities for sustainable development	Strategic capability of sustainable economic development	Y1
	Strategic capability of sustainable social development	Y2
	Strategic capability of sustainable environmental development	Y3
Risk and uncertainty propositions	Risk of confiscation of oil and gas exports due to sanctions by world powers	X1
	Risk of bribery and collusion in the development of oil industry investment projects	X2
	Risk of political instability among politically active factions in the development of oil and gas projects	X3
	Risk of industrial terrorism due to cyber intrusion into and disruption of oil and gas systems	X4
	Risk of changes in domestic law relative to political/economic diplomacy in the development of oil industry infrastructure	X5
	Risk of changes in upstream technology under technological dependencies	X6
	Sufficiency risk of exploration wells and evaluation of the development of future investment projects	X7

7. Rough analysis

In this step, coding is used by separating the reference variables from the member variables, improving understanding, and making significant inferences to determine the weight of these criteria.

	Technical and knowledge risks in geology for the development of oil and gas fields, such as the type of structure.	X8
	Risk of failure to accurately estimate requirements	X9
	Risk of expertise and efficiency of employers in charge of oil and gas development projects	X10
	Accident management risk in investment projects in the oil industry	X11
	Risk of oil and gas leakage at sea and an increase in environmental pollution	X12
	Risk of supply and development of oil industry projects	X13
	Operational risks, such as breakdowns and shutdowns of machinery in the development of oil and gas projects	X14
	Risk of insufficient expertise in the development of oil and gas projects	X15

It is now time to calculate the weight of the research criteria with a gray hierarchical analysis process after developing the research propositions and components. To this end, the experts' opinions were collected after forming a pairwise comparison matrix. The next step involved determining the extent to which every pairwise comparison matrix was incompatible. The next step may be launched if the pairwise comparison questionnaires' incompatibility (inconsistency) value is standard (less than 0.1). The pairwise comparison questionnaires would otherwise be returned to experts for review. The experts' opinions were converted to interval numbers after confirming the compatibility value of pairwise comparison questionnaires using rough theory (Equations (1)–(6)). Lastly, the weight of the criteria was obtained using Equations (8)–(10). The results from gray hierarchical analysis calculations are shown in Table 11.

Table 11. Results of the gray-hierarchical analysis process.

Purpose	Criteria weight		Element	Element weight		Final element weight	
	Lower bound (L)	Upper bound (U)		Lower bound (L)	Upper bound (U)	Lower bound (L)	Upper bound (U)
Components of strategic capabilities for sustainable development	0.79	0.87	Y1	0.179	0.244	0.163	0.244
			Y2	0.123	0.169	0.108	0.169
			Y3	0.271	0.312	0.255	0.312
Risk and uncertainty propositions	0.49	0.63	X1	0.250	0.322	0.221	0.322
			X2	0.308	0.396	0.299	0.396
			X3	0.443	0.571	0.410	0.571
			X4	0.412	0.502	0.398	0.502
			X5	0.269	0.375	0.231	0.375
			X6	0.610	0.713	0.602	0.713
			X7	0.257	0.341	0.211	0.341
			X8	0.330	0.420	0.303	0.420
			X9	0.702	0.791	0.668	0.791
			X10	0.454	0.562	0.419	0.562
			X11	0.188	0.269	0.120	0.269
			X12	0.432	0.560	0.401	0.560
			X13	0.209	0.289	0.195	0.289
			X14	0.292	0.358	0.231	0.358
			X15	0.166	0.283	0.121	0.283

Depending on the final weight of each component and proposition, their incompatibility was found to be lower than 0.1. Therefore, the second round of rough analysis can be conducted. The next step is to form a problem decision matrix after calculating the weight of the research criteria. The experts' opinions on the situation of each alternative were initially collected using the Vikor questionnaire to form the interval decision matrix, the results of which are presented in Table 12.

Table 12. Expert opinion on each option based on each criterion.

First participant															
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
Y1	14	5	3	13	12	5	8	3	12	10	7	5	14	12	14
Y2	13	14	13	6	11	5	4	7	6	13	13	7	5	4	10
Y3	5	4	3	7	10	12	6	9	5	4	6	15	5	6	6
Second participant															
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
Y1	14	7	5	14	12	6	6	4	13	12	6	7	13	11	13
Y2	14	13	14	8	10	7	7	10	7	10	11	6	9	5	12
Y3	7	8	3	8	13	13	8	10	4	5	7	15	7	7	8

* Note: Due to the page limitation of the paper, only the answers of the two participants are provided.

After the experts' opinions on the status of each option in each proposition are distributed and analyzed, a decision matrix is created to analyze the problem. The analyses of 32 senior managers in companies operating in the oil industry as members of the target population of the quantitative section need to be translated into the interval numbers to form a decision table. Score analyses are converted to interval numbers by using Equations (1)–(6). Table 13 presents the interval decision matrix obtained from the rough method:

Table 13. Interval decision matrix for process analysis.

	X1		**X2**		**X3**		**X4**		**X5**		**X6**		**X7**	
	Lower bound (L)	Upper bound	Lower bound (L)	Upper bound	Lower bound (L)	Upper bound	Lower bound (L)	Upper bound	Lower bound (L)	Upper bound	Lower bound (L)	Upper bound	Lower bound (L)	Upper bound
Y1	29.56	32.02	18.01	26.16	25	28	2.066	29.18	34	37	1.908	21.44	1.149	20.88
Y2	28.79	30.14	17.11	2.093	2.567	29.19	27	29	2.179	31.10	22.69	24.15	17.65	19.12
Y3	30.30	32.89	14.77	16.46	26.15	2.967	25.90	2.117	31.12	3.024	17.63	1.919	22.81	2.014

	X8		**X9**		**X10**		**X11**		**X12**		**X13**		**X14**	
	Lower bound (L)	Upper bound (U)	Lower bound (L)	Upper bound (U)	Lower bound (L)	Upper bound (U)	Lower bound (L)	Upper bound (U)	Lower bound (L)	Upper bound (U)	Lower bound (L)	Upper bound (U)	Lower bound (L)	Upper bound (U)
Y1	26.15	27.17	20.20	21.13	13	15	24.56	16.39	27.80	29.20	20.60	22.01	14.94	16.33
Y2	28.55	30.07	19.16	20.09	14.49	16.50	23.70	15.10	28.17	30.45	19.19	21.10	13.08	14.61
Y3	26.76	28.11	18.40	19.93	13.79	15.32	19.55	19.81	28.51	30.76	17.50	19.13	19.10	21.15

	X15	
	Lower bound (L)	Upper bound (U)
Y1	20.71	23.54
Y2	21.09	24.11
Y3	20.55	22.64

(light shading)	Ranked first in the effectiveness of propositions
(medium shading)	Ranked second in the effectiveness of propositions
(light shading)	Ranked third in the effectiveness of propositions

The risk associated with changes in domestic legislation relative to political and economic diplomacy in the growth of oil and gas infrastructure (X5) as a central proposition for risk and uncertainty in the area of political and legal risks, which should be considered as a criterion influencing strategic capabilities for sustainable development. The risk of oil and gas exportations being confiscated as a result of world powers sanctions (X1) has also been found to be another significant proposition of the set of risk and uncertainty propositions in the field of political and legal risks, which ranked second in terms of affecting the strategic capabilities for sustainable development. It was also found that the risk of oil and gas spills at sea and increased environmental pollution (X12) as a structural and management risk proposition ranked third for the effectiveness of the strategic capabilities for sustainable development. Research propositions must now be re-analyzed to perform gray Vikor analysis. The gray Vikor approach is used to optimize the reference variable criteria (risk and uncertainty propositions) of the most efficient legal component as the most critical feature of rough analysis (components of strategic capabilities for sustainable development). In other words, this step involves selecting the most effective legal variables, i.e., strategic capabilities for sustainable development. To this end, the degree of positive ideals (f_j^*) and negative ideals (f_j^-) must be determined in the form of each of the decision matrix parameters after creating the decision matrices. The results obtained are presented in Table 14.

Table 14. Determining positive and negative ideals.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
(f_j^*)	32.61	16.90	26.17	27.14	36.46	20.57	18.83	23.12	20.82	19.78	19.14	30.28	20.24	1.18	2.75
(f_j^-)	17.33	12.48	17.20	17.37	18.65	13.16	13.02	15.15	15.57	13.43	13.26	16.96	14.07	1.221	1.095

As shown, none of the propositions has a higher negative ideal than the positive ideal, indicating the effectiveness of all the propositions concerning strategic capabilities for sustainable development. However, the results reaffirmed the risk of changing domestic laws concerning policy/economic diplomacy for the development of the infrastructure of the oil industry (X5), as the most significant risk and uncertainty proposition in the area of political and legal risks, which has a more significant impact on sustainable strategic capabilities than the other propositions. This result shows that if controlled, this proposition plays a significant role in sustainable strategic capabilities among the set of risk and uncertainty propositions. However, the Q-criterion analysis should be used as a measure of gray Vikor to identify the most effective strategic capabilities for sustainable development based on risk and uncertainty propositions in the oil industry. That is, S_i^U, S_i^L, R_i^U, R_i^L are determined first based on Equations (16)–(19). Then, following the determination of propositions, the principal proposition of Gray VIKOR, i.e., Q, is specified from Equations (20) and (21). The results of the calculations are listed in Table 15.

Table 15. Analysis of Gray Vikor propositions.

Sustainable development strategies	Code	S_i^U	S_i^L	R_i^U	R_i^L	Q_i^U	Q_i^L
Strategic capability of sustainable economic development	Y1	1.100382	2.302211	0.337070	0.451425	0.399032	0.5843393
Strategic capability of sustainable social development	Y2	1.121834	2.427365	0.397308	0.555426	0.483760	0.6008376
Strategic capability of sustainable environmental development	Y3	1.534555	2.902918	0.443870	0.810297	0.703243	0.8231441
Assessment criteria	Propositions		S^*	S^-	R^*	R^-	
	Proposition value		0.805536	3.223918	0.612443	1	

The strategic capability for sustainable development 'Y1' is the essential capability of strategic development capabilities that need to be considered in the oil industry, based on the analytical criterion Q, as a measure of Gray Vikor analysis. Additionally, given that Q_i^L is equal to 0.6008, the strategic capabilities for sustainable social development ranked the following strategic capabilities for sustainable environmental development. Accordingly, the strategic capabilities of sustainable economic development are the principal capabilities under sanctions that should be noticed under the most potential risks, including the risk of changes in domestic regulations relative to political/economic diplomacy in developing the infrastructure of the oil industry (X5), and the risk of confiscating oil and gas exports due to sanctions of world powers (X1).

8. Conclusions

The conclusion indicated the risk of changing domestic regulations relative to political/economic diplomacy (X5). In analyzing this proposition, it should be noted that failure to use diplomatic potentials, both politically and economically, to attract knowledge or capital for oil and gas production and exploration, on the one hand, and to attract foreign capital and use oil sales opportunities among competing countries, on the other hand, contribute to increased risks in the development of the oil industry infrastructure. The results of this research were consistent with those of Jagoda and Wojcik (2019), Jiang et al. (2019), Sumbal et al. (2018), Singla et al. (2018), Reed and Arayici (2015), and Roosta et al. (2019).

Based on the results obtained, firms operating in the oil industry are suggested to attract technical and technological knowledge to develop exploration, mining, and production infrastructure in this industry by enhancing political and economic diplomacy with businesses with indigenous knowledge, including within developed countries. The strength and capacity of internal knowledge can also help pave the way for the growth of strategic capabilities for future sustainable development. It is also proposed that risk planning be constantly evaluated, and the damage caused by these risks should be taken as alternative scenarios to control risk and uncertainty in developing oil industry plans and projects. This enables them to make the best decisions to control the risks and uncertainties in the shortest possible time.

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